

## Kentucky Geological Survey

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*Kentucky Geology*

Our mission is to  
increase knowledge and  
understanding of the  
mineral, energy, and  
water resources,  
geologic hazards, and  
geology of Kentucky for  
the benefit of the  
Commonwealth and  
Nation.

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
Have you ever had questions about geology in Kentucky? Now you can find out what publications KGS has to offer with just a few clicks of your mouse, because the KGS publications catalog is available in a searchable database on our Web site ([www.uky.edu/KGS/pubs/lop.htm](http://www.uky.edu/KGS/pubs/lop.htm)). You can search by author, title, or keyword. Or you can search by KGS series (bulletins, information circulars, reports of investigations, etc.). Many recent publications are also available online: you can download a PDF file and view it using Acrobat Reader (available free online from Adobe). If you want to know what a particular

publication is about, you can read its abstract or executive summary (available for most of our recent publications).

KGS has made every effort to ensure that the database is complete and up to date: all publications listed in the November 1999 printed *List of Publications* have been

incorporated into the online database, and new publications released since that date have been added.

For further information about the online database, please contact **Doug Curl** at 859.257.5500 ext. 178 or by e-mail at [dcurl@kgs.mmm.uky.edu](mailto:dcurl@kgs.mmm.uky.edu). ♦



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J.A. Stokley and F.H. Walker	<i>High-calcium limestone in the Somerset, Pulaski County, area</i>	1952	8 p.	<a href="#">PDF FILE</a>
J.A. Van Couvering	<i>Characteristics of large springs in Kentucky</i>	1962	37 p	<a href="#">PDF FILE</a>
J.C. Cobb and C.F. Eble	<i>Sulfur in Kentucky coal and the Clean Air Act Amendments of 1990</i>	1992	14 p	<a href="#">PDF FILE</a>

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*Example of a search result of the online publications catalog.*

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## New geophysicist at KGS—

### Introducing Zhenming Wang

Zhenming Wang spent the last several years studying earthquakes in the Pacific Northwest, a seismically active region. In July, Zhenming Wang joined the Geologic Hazards Section of KGS. He brings to KGS expertise as a geophysicist and engineer, as well as professional experience as an earthquake specialist. Dr. Wang graduated from the University of Kentucky

(UK) with a doctorate in geological sciences in 1998.

Dr. Wang wanted to return to UK because of the emphasis on academic research in the seismic research program established here, the statewide seismic network, the near-surface geophysical equipment and software at KGS, and the opportunity to collaborate with other researchers at KGS and

across campus. Dr. Wang will emphasize three research priorities.

(Continued on page 2)



Zhenming Wang.

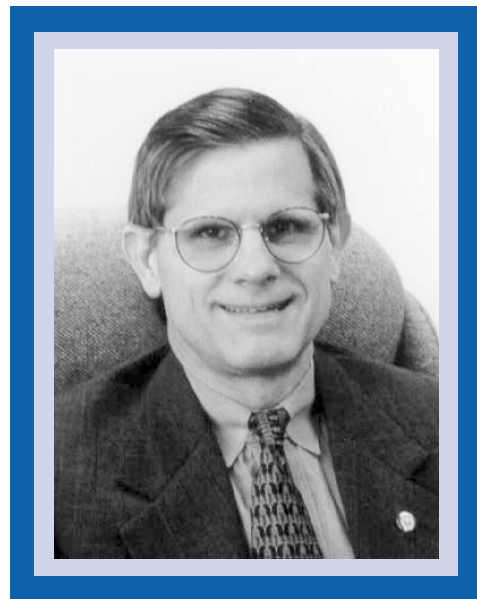
## Director's Desk



More than a year ago, KGS imposed upon its friends, clients, and contacts in the geological community to help us determine the uses and value of Kentucky's geologic quadrangle maps. Perhaps you were one of the 2,200 geologists who received one of our lengthy questionnaires. I am extremely grateful to all of you who did such a good job of filling them out. I know it wasn't easy. Some of the questions took quite a bit of work. I could tell by looking at the responses that many of you spent time working out your answers.

More than 600 questionnaires were completed, giving us a very high return percentage of more than 25 percent. I would like to take this opportunity to say thank you for helping us evaluate Kentucky's geologic quadrangle maps. The *In Focus* article in this issue shares the findings from the questionnaire with all of you. The findings are important because they point out how valuable the maps are and also how valuable geologic work is in general to society. Without the conscientious involvement of our geological community, this work would not have been possible. ❖

*James C. Cobb*



*(Zhenming Wang, continued from page 1)*

(1) *Earthquake Risk*: The Federal Emergency Management Agency (FEMA) has estimated that annualized earthquake loss in Kentucky is \$18.7 million. Earthquake risk is different from locality to locality. Better information on earthquake risk is needed for policy makers in both the public and private sectors to guide decisions about building codes, insurance premiums, highway design, bridge construction, etc. Information about earthquake risk can also be used to inform policy makers about the Paducah Gaseous Diffusion Plant in western Kentucky.

(2) *Near-Surface Geophysics*: It is important to map soils near the surface of the earth in order to better understand the location of faults and movement of the earth, site conditions underneath

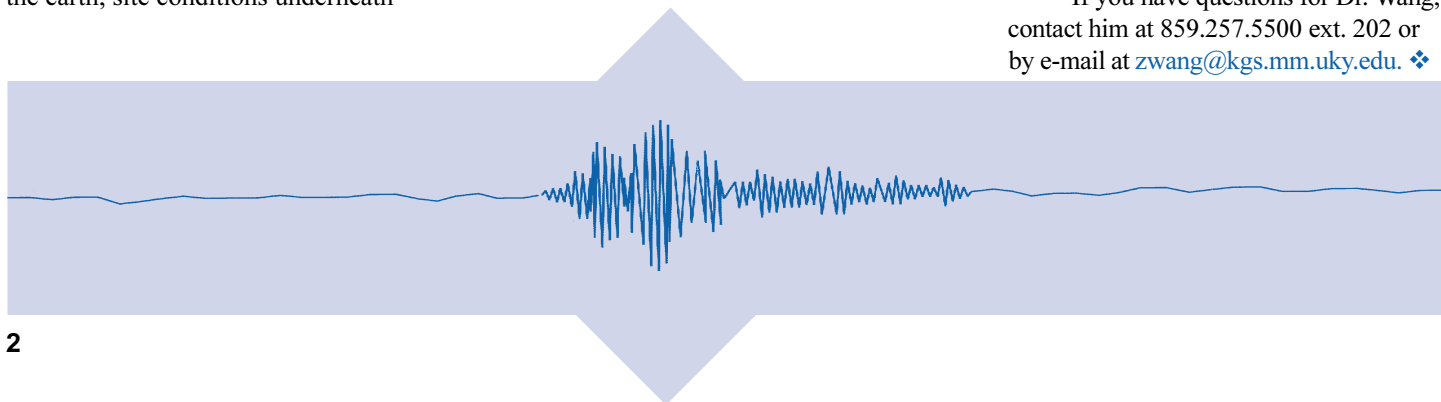
lifeline facilities (e.g., highways, power lines, ports, and pipelines), contaminant transport in ground water, etc. Near-surface geophysics provide a powerful tool in characterizing near-surface soils. Using the modern near-surface geophysical equipment and software, we are able to provide better near-surface geologic and soil information at critical facility sites such as a lock and dam along the Ohio River and the Paducah Gaseous Diffusion Plant.

(3) *Geologic Hazards Mapping*: Geologic hazards, such as earthquakes, landslides, and karst, could cause property damage and loss of life. Geologic hazard maps, derived from geologic, engineering, and topographic

data with a geographic information system (GIS), can provide useful information for local communities to mitigate those hazards. The maps will delineate potential high geologic hazard areas in a community or region. This information can be used by public-sector decision makers for siting the location of landfills, schools, and hospitals. The maps can also be used by private-sector decision makers.

Dr. Wang brings a great deal of expertise to KGS. In addition to his doctorate in geological sciences, he has an M.S., also from UK. He has a B.S. and M.S. in civil engineering from UK, and is a registered professional engineer. And he has a B.S. in geology from Peking University in China.

If you have questions for Dr. Wang, contact him at 859.257.5500 ext. 202 or by e-mail at [zwang@kgs.mmm.uky.edu](mailto:zwang@kgs.mmm.uky.edu). ❖



One of the most important accomplishments of the Kentucky Geological Survey (KGS) in its 163-year history was completing a project to geologically map the entire state at a detailed scale of 1:24,000 (1 inch on the map equals 2,000 feet on the ground). The project, carried out in cooperation with the U.S. Geological Survey, resulted in 707 geologic quadrangle maps (GQ's) being published from 1960 to 1978; each map covers a 7.5-minute by 7.5-minute area. The maps are provided to the public at low cost, and have been the best-selling geologic publication in Kentucky ever since the first one rolled off the press in the early 1960's. More than 81,000 maps have been sold since then, and approximately 5,000 are still sold each year, attesting to their continuing popularity.

This popularity is an indirect measure of how much the maps are valued, but there had been no formal estimation of their value until Subhash Bhagwat and Viju Ipe made an economic evaluation in 2000. Bhagwat and Ipe, both mineral economists with the Illinois State Geological Survey, wanted to know the value of Kentucky's GQ's because the Illinois Survey has just begun a program to map the entire state of Illinois at the same scale that Kentucky did. The Kentucky maps were an ideal study case because they've been in circulation for more than 25 years, long enough for a meaningful evaluation.

KGS scientists cooperated with Bhagwat and Ipe to design a questionnaire that asked these basic questions:

- ❖ How are the maps used?
- ❖ What are the maps worth to the user?
- ❖ What are the maps worth to the state?

KGS mailed the questionnaires to the 2,200 geologists registered with the Kentucky Board of Registration for Professional Geologists; 20 percent of the questionnaires were returned. KGS staff tabulated the responses, and Bhagwat and Ipe analyzed the responses.

## How are the maps used?

The responses indicated a wide variety of uses for the maps (see chart, below), some of which could not have been anticipated at the time the mapping program began.

### How people use Kentucky geologic quadrangle maps (modified from Bhagwat and Ipe, 2000)\*:

Category	Map use	Percent of respondents
Exploration & development	Coal	30
	Oil & gas	32
	Industrial minerals	32
	Ground water	73
Environmental consulting	Pollution prevention	53
	Industrial applications	41
	Site clean-up	68
Hazard prevention & protection	Landslides	33
	Earthquakes	14
	Karst problems	54
	Subsidence	40
Engineering	Buildings & foundations	37
	Roads & highways	35
	Railroads	16
	Pipelines	30
	Utilities	26
	Dams, dikes, & locks	27
City planning	Zoning decisions	17.5
	Landscape planning	11
	Building codes	7.5
Regional planning	Waste disposal	45
	Transportation	16
	Industrial permits	38
Property valuation	Property tax assessment	11
	Land acquisition	35

\*Sum of percentages exceeds 100 because each user reported more than one map use.

Some of the most common uses were:

- ❖ Exploring for and developing ground-water resources
- ❖ Cleaning up environmentally damaged sites
- ❖ Avoiding karst hazards
- ❖ Designing foundation engineering
- ❖ Making zoning and city planning decisions
- ❖ Locating waste-disposal facilities
- ❖ Evaluating property

### *What are the maps worth to the user?*

This question was answered in several different ways. The users said they saved an average of \$43,527 because the maps were already available and therefore they didn't have to do the mapping themselves. Gathering only *the minimum* amount of information necessary for them to do a credible job would have cost an average of \$27,776.

Geologic mapping was so vitally important to their work that they estimated a map was worth 17 percent of their total project cost. The users held GQ's in such high esteem that they would be willing to pay \$342 *per map*!

### *What are the maps worth to the state?*

The mapping program was funded by both Federal and State tax dollars. Have the taxpayers gotten their money's worth? If we multiply \$27,776 (cost to gather minimum information necessary to do a credible job) by 81,000 (total number of GQ's sold), we get a minimal value of \$2.25 billion for the maps; if we multiply the 81,000 maps sold by \$43,527 (the amount already having a GQ available saved the users), we get a maximum value of \$3.53 billion for the maps. If we subtract the cost of the mapping program (\$90 million, in 1999 dollars) from the minimum value of \$2.25 billion, we see a net gain of \$2.16

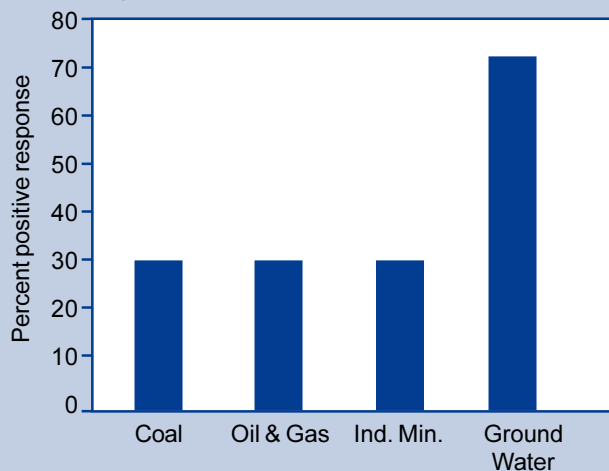
billion. This is a remarkable return on the taxpayers' investment!

The public has been extremely well served by the mapping program, as demonstrated by this cost-benefit analysis. Even if you've never bought a geologic quadrangle map, you still benefit from the maps. That's because economists consider GQ's "public goods," much the same as roads, dams, and reservoirs are—in fact, GQ's make it possible to build better roads, dams, and reservoirs, and build them more economically. And the public will continue to reap the benefits of the maps, because the information they contain will continue to be used for many more decades.

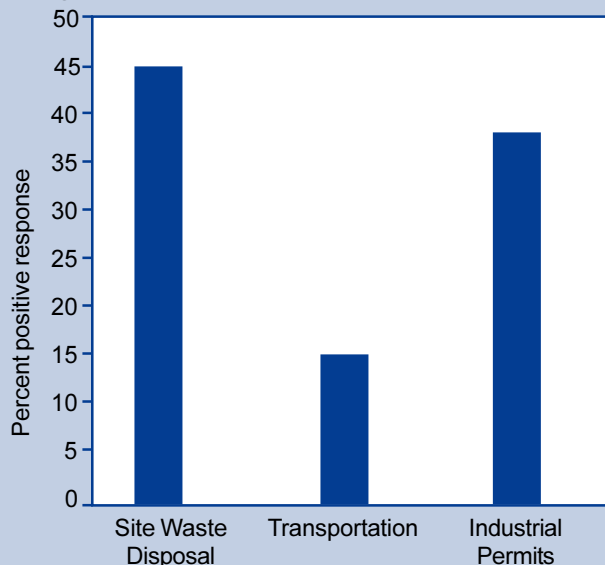
### *References cited*

- Bhagwat, S., [2000], Recent study validates ambitious geologic mapping program: Illinois State Geological Survey, 4 p.
- Bhagwat, S.B., and Ipe, V.C., 2000, What are geologic maps worth: Geotimes, December 2000, p. 36–37. ❖

**Map use for exploration and development (modified from Bhagwat, 2000)**



**Map use in regional planning (modified from Bhagwat, 2000)**





### Seismic loads and hazardous-waste landfill

The northern boundary of the New Madrid Seismic Zone is not well defined. **Ed Woolery** and **Zhenming Wang** are trying to determine whether the seismic zone extends as far north as Paducah. This will have important economic implications for Kentucky in general, and for Paducah in particular in defining building codes.

Dr. Woolery and Dr. Wang are working with the U.S. Department of Energy, the U.S. Environmental Protection Agency, and State government officials in Kentucky to determine what “seismic load” a hazardous-waste landfill at the Paducah Gaseous Diffusion Plant must be designed to withstand (a “seismic load” is analogous to a snow load on a roof or a hurricane force on a side of a building).

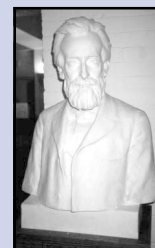
For more information, contact Ed Woolery or Zhenming Wang at 859.257.5500 ext. 202, or by e-mail at [ewoolery@kgs.mm.uky.edu](mailto:ewoolery@kgs.mm.uky.edu) or [zwang@kgs.mm.uky.edu](mailto:zwang@kgs.mm.uky.edu). ❖

### KGS donates specimens to Peabody Museum

When a representative from the Peabody Museum of Archaeology and Ethnology recently contacted the Kentucky Geological Survey about specimens that had been on loan from KGS for 126 years, it was a surprise to everyone at the Survey. The specimens, Native American skeletal remains, had been deposited in the museum by Nathaniel Shaler in 1875. The museum is part of Harvard University, and Shaler, a native Kentuckian, was a professor of

paleontology at Harvard. He was also Kentucky’s second State Geologist from 1873 to 1880. The remains were discovered by Shaler in the 1870’s while he was doing field work in Kentucky.

The museum is in the process of establishing ownership of its collection of Native American remains, to comply with the American Indian Graves Protection and Repatriation Act. Current State Geologist **Jim Cobb** was pleased to formally donate his predecessor’s specimens to the museum. ❖



*This bust of Nathaniel Shaler is on display at the geology library at Harvard University. Photo by Jim Cobb.*



### Spotlight on new publications

#### “Space Visitors in Kentucky: Meteorites and Meteorite Impact Sites in Kentucky”

Imagine how a couple from Burnwell, Ky., felt when a meteorite fell through the roof of their home in September 1990. **William Ehmann** describes this incident and the 26 other meteorite falls known for Kentucky. He also explains how meteorites are classified and identified.

This publication complements the collection of meteorites Dr. Ehmann donated to the Kentucky Geological Survey in 1999. The collection is on display in the foyer of the Mining and Mineral Resources Building. **Warren Anderson**, mineral curator at KGS, has said, “This book, together with the meteorite display, gives the citizens of the Commonwealth a tremendous opportunity to understand these fascinating rocks from space.”

In addition to “Space Visitors,” Dr. Ehmann has published many articles on the chemical composition of meteorites, and studied the chemical composition of

the Apollo Mission lunar samples from NASA. ❖

#### “Cored Rocks of the Southern Appalachian Coal Fields”

This manual by **John Ferm** and **Jerry Weisenfluh** is a guide for describing rocks obtained from core drilling in the Appalachian coal fields. It includes color photographs of the common rock types found during drilling of Carboniferous strata, as well as a system for rapidly recording important lithologic properties. The books are printed on durable plastic stock for convenient use under any field conditions. In an effort to make this publication more widely available, the price has been reduced from \$50 to \$15. ❖

#### “Geologic Map of Kentucky”

A new 1:100,000,000-scale geologic map of Kentucky shows the rocks and sediments at the surface (shale, limestone, sandstone, and siltstone). Text by **Garland Dever** describes 10 features of geologic interest in Kentucky, including earthquakes in the New Madrid Seismic Zone, the deepest oil well drilled in the

state, Mammoth Cave National Park, the Falls of the Ohio, impact sites of meteorites, several state parks, the Palisades of the Kentucky River, Red River Gorge Geological Area, and Pine Mountain. ❖

#### “Regional Subsurface Geologic Cross Sections of the Mississippian System, Appalachian Basin, Eastern Kentucky”

**Dave Harris** and **Tom Sparks** have completed a series of 14 regional geologic cross sections that illustrate the structure and stratigraphy of subsurface rocks in eastern Kentucky. The cross sections document the structure, thickness, lithology, and porosity of the rock units. These are important parameters used by geologists and engineers in oil and gas exploration. The cross sections are available for downloading at no charge from the KGS Web site ([www.uky.edu/KGS/petro/biglime.html](http://www.uky.edu/KGS/petro/biglime.html)). The publication is also available for purchase on CD-ROM. In addition to containing the cross sections, the CD-ROM contains the digital log data for 163 wells, in LAS format (ASCII). ❖

## *KGS mailing list*

Would you like to receive the KGS newsletter and announcements of meetings and new publications? If so, we would like to add your name to our electronic mailing list. Please call us at 859.257.5500 or send an e-mail message to **Jennifer**

**Talley** at [jtalley@kgs.mm.uky.edu](mailto:jtalley@kgs.mm.uky.edu)—simply type “Electronic-Mailing List Addition” in the subject line of your message, type your mailing address and phone and fax number in the message—and we will include your name and address in our mailing list. ❖

## *Calendar of events*

- ♦ **October 7–13, 2001:** Earth Science Week
- ♦ **November 5–8, 2001:** A Geo-Odyssey: GSA Annual Meeting, John B. Hynes Veterans Memorial Convention Center, Boston, Mass., [www.geosociety.org/meetings/2001/](http://www.geosociety.org/meetings/2001/)
- ♦ **March 10–13, 2002:** American Association of Petroleum Geologists (AAPG) Annual Convention and Exhibition, Houston, Tex., [convene@appg.org](mailto:convene@appg.org) (e-mail), [www.aapg.org](http://www.aapg.org) (Web site)
- ♦ **April 3–5, 2002:** Geological Society of America Southeastern–North-Central Section Meeting, Lexington, Ky., [www.uky.edu/kgs/gsa2002/](http://www.uky.edu/kgs/gsa2002/) ❖

## *Do you want to know about the wetlands of Kentucky?*

Wet areas such as marshes, swamps, ponds, and bogs are commonly referred to as “wetlands.” Wetlands support migratory birds, fish, and aquatic plants, and provide natural flood and erosion control. Each year, 458,000 acres of wetlands across the country are lost to development, drainage, and agriculture. In 1977, the U.S. Fish and Wildlife Service began the National Wetlands Inventory, a systematic effort to classify and map the remaining wetlands in the United States. The complete set of maps for Kentucky from the inventory are available from KGS for a nominal fee. The maps are useful for many purposes,

including land-use planning, flood-hazard planning, and wildlife habitat management. For more information, please contact **Richard Smath** at 859.257.5500 ext. 119 or by e-mail at [rsmath@kgs.mm.uky.edu](mailto:rsmath@kgs.mm.uky.edu). ❖

## *Input in design of national geologic maps database*

Jerry Weisenfluh was appointed on June 18 to the U.S. Geological Survey’s National Datamodel Steering Committee. This group oversees the design and implementation of national databases that relate to geologic maps and was created in association with the National Geologic Mapping Act. ❖

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